GEOGRAPHIC SCHOOL BULLETINS

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- Ancient Beauty Spots: The Isles of Greece
- Crystals—An Everyday Wonder
- Fearsome Squid Drafted by Science
- National Parks—Your Wild Estate

GILBERT M. GROSVENOR, NATIONAL GEOGRAPHIC STAFF

SMILING CRETAN grape grower, wearing the traditional beret, persuades a living out of the land much the way his father and grandfather did. He typifies farmers everywhere on the sun-drenched islands that spangle the seas between Greece and Asia Minor. Although foreign invaders have overrun his island periodically since the Trojan War—about 1200 B.C.—he remains Greek to his earthstained finger tips. He clings tenaciously to the language, religion, and customs of the mainland. The area is explored fully in the December, 1958, *National Geographic*. See also the map "Greece and the Aegean," in the National Geographic Atlas series.

konos, Ándros, and on through hundreds of others. On their rocky cliffs, they hold the ruins of ancient civilizations, sites of history-making battles, and homes of Greek gods.

Settled by Greeks between 1000 and 700 B.C., the Aegean Islands have been ruled by Athens, Macedonia, Rome, Byzantium, Crusaders, Venice, Ottoman Turks, and Nazis. Yet their culture has remained Greek to the core, from Rhodes to Lésvos, island of the poet Sappho.

Greek is the language; the Greek Orthodox Church, the center of religion. While Greece lived under Moslem rule, parish priests kept nationalism alive.

Islanders clench their Greek customs tightly to them. A lemon grove owner offers a sprig of mint to the visitor, just as his mainland counterpart does.

Long ago, the islands bustled with activity. Lying between Europe and Asia, they were hosts to traders from all over the world. But their location also made them coveted possessions of great empires. War took its toll, and today little remains of the humming business once carried on in the Aegean.

Today, most islanders till the soil, or go down to the sea for fish and sponges. They live in gleaming whitewashed houses that climb rocky hillsides, like the one below on Skópelos.

On the island of Rhodes in the Dodecanese, modern architecture, left over from Mussolini's occupation, mingles with medieval towers built by the Crusaders. Driven from the Holy Land, the Knights Hospitalers of St. John occupied the island in 1309. Accustomed to European fortresses, the knights encircled nearly a whole community with moats and walls. Today the palace they built for their Grand Master is a museum.

Rhodes is the largest of the Dodecanese and site of the capital—also Rhodes. Dodecanese means "12 islands." Actually, there are 14 in the chain plus many islets and reefs within sight of Turkey. In their 1,035 square miles, 121,000 Greeks make their homes. Some few are farmers, but the soil yields little, and most make their living from the sea.

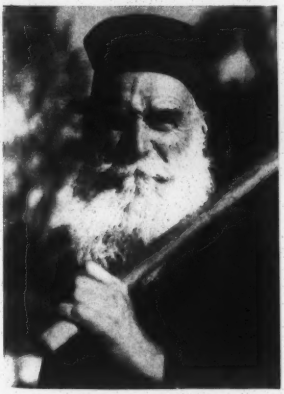
Ídhra, lying just off the Greek mainland, was once known for its wealth. The barren land forced the original settlers to change from farmers to seafarers. They made the island rich from trade in silks, rare woods, spices, and tapestries. In the 18th century, palatial homes rose in Ídhra City. Some of the richest men of the Aegean lived there. When Greece

Photographs by Gilbert M. Grosvenor, National Geographic Staff

The Sunny Isles of Greece

STEPPINGSTONES BETWEEN EUROPE AND ASIA

SUN-BAKED AND SCARRED by bands of lava, the island of Thíra juts from Aegean waters (above), its cliffs soaring 1,000 feet skyward. It is one of a remarkable chain of steppingstone-islands that gave ancient man short sailing distances and easy landfalls between continents. Today, its 30 square miles form a tiny crescent world shaped by a steaming volcano. People live constantly under threat of earthquake. They dig the first stories of their whitewashed houses into cliffs. Roofs are barrel-vaulted to withstand rockslides. But quakes have shattered many buildings and even lopped off chunks of the island itself.



Thíra is in the Cyclades group, one of the clusters that make up the Aegean Islands. The farmer at right might tell you that the islands resulted from a battle between Zeus and the Titans. Trying to oust the king of the gods from the sky, the Titans threw boulders that piled up the mountains of Greece. Stray rocks rolled into the sea, and the islands were born.

Their names have a poetic ring: Náxos, Skíathos, Skópelos, Thásos, Khíos, Sámos, Pátmos, Tínos, Mí-

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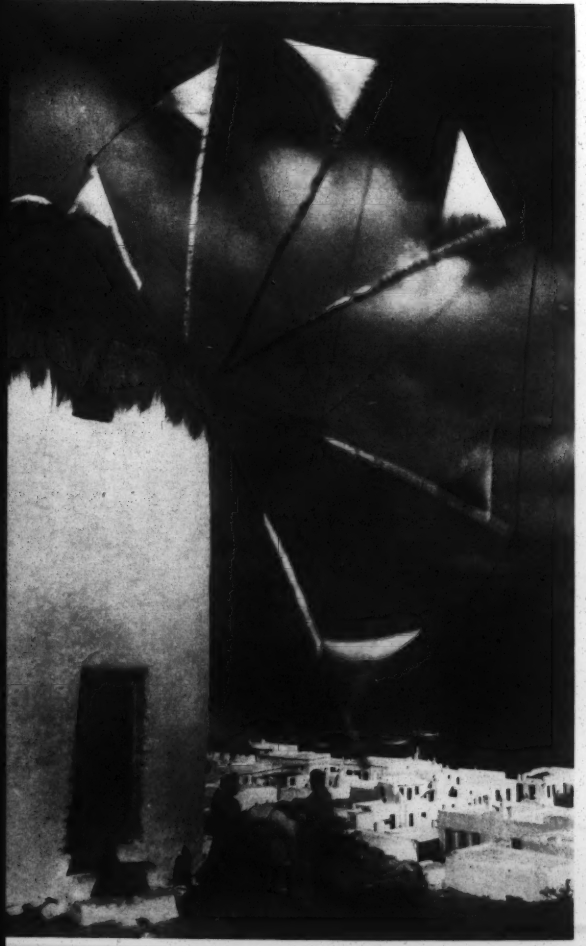

ical center of Greece and commercial center of the Aegean Sea. War toppled the island from its lofty status in the last century B.C., and today only a caretaker's family and visitors save it from total desertion.

Its importance lies in its former glory. Legend says the god-twins Apollo and Artemis were born there, and the island became a shrine for gift-bearing pilgrims.

Today, ancient history comes alive in the remains of those shrines. Temples have been excavated. Five of the nine dog sentinels that guarded the Sacred Way to Apollo's temple 2,600 years ago have been restored to their places.

Tales that wrap the Aegean world in mythology are on the tip of the islander's tongue. He is proud to say that one of the Argonauts who sailed with Jason in quest of the Golden Fleece was the first inhabitant of Skópelos. He tells how the sea god Poseidon sends great stallions and monsters to churn up the ocean. He tells how Danaus, ruler of Libya, fleeing from his homeland with his 50 daughters, was helped by Athena to build the world's first two-prowed vessel. The refugees landed on Rhodes and built a temple in Athena's honor. Three of the daughters died on Rhodes, and ancient cities bore their names. The other 47 are supposed to be in Hades trying to fill a leaky jar with water they carry in sieves.

War is the thread that runs through the Aegean Islands. From the Trojan War, about 1200 B.C., to the late Nazis, the islands have weathered successive periods of strife.

But they continue to bounce back to freedom, a fitting reaction from Greeks, who gave the modern world both the concept and word "democracy." L. B.

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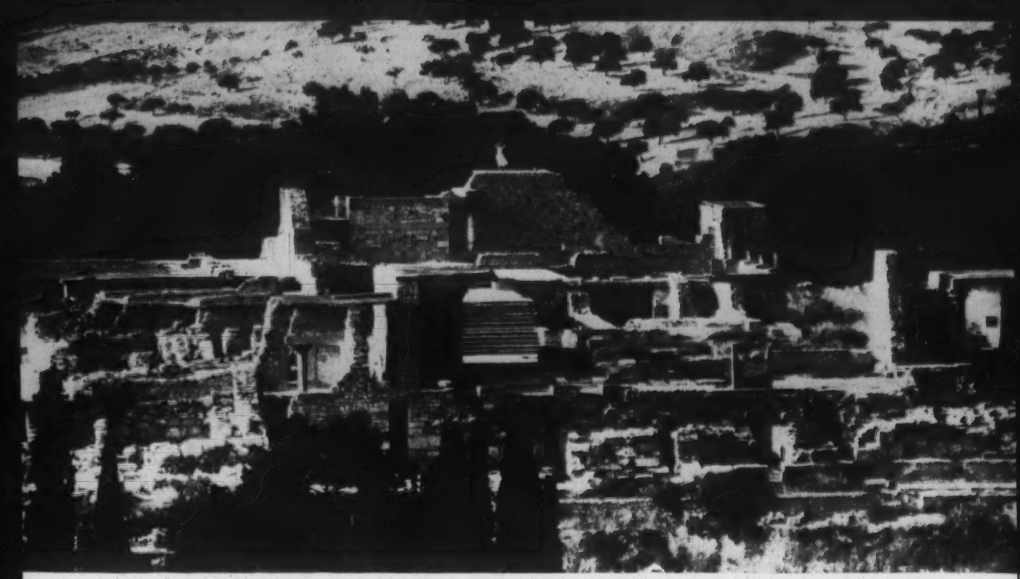
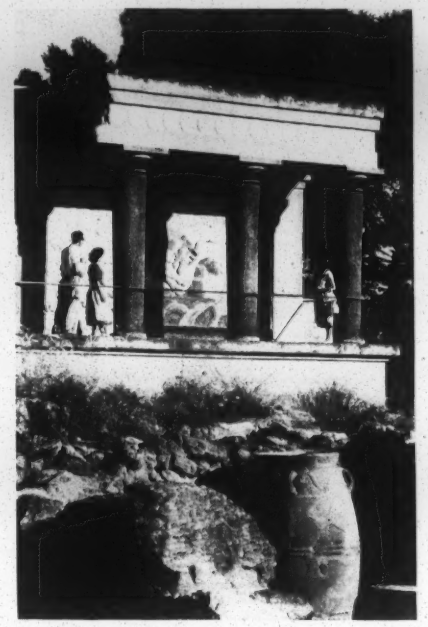


FORTY CENTURIES AGO King Minos lived in this palace which included many "modern" fixtures. Below, a closer view shows painting done in the style of Minoan artists. It depicts the sacred bull over whose horns Cretan youths vaulted.

revolted against Turkish rule in the early 19th century, war drained the island of its wealth. Today some 3,000 people, most of them poor fishermen and sponge divers, work the waters where sleek trading vessels once carried great riches.

Rugged Crete, separated from the Aegean Islands by the Sea of Crete, was already old when the ancient poet Homer sang of it. It was the center of Minoan culture, the most ancient forerunner of Greek civilization.

Ancient though it was, it had many of the facets of "modern" civilization including written records, money, a modern style of art, and even indoor plumbing. Women were regarded as equals, drove chariots, wore lipstick, and had an eye for fashion. The palace of King Minos (above), legendary labyrinth where Theseus slew the Minotaur, was built some 4,500 years ago on modern engineering principles. It had running water, a complex network of state apartments, bedrooms, storerooms, and courtyards.



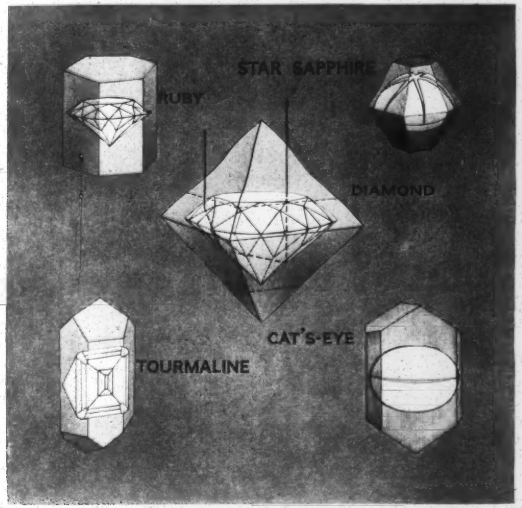
Today's Cretan is less advanced in some ways. In most cases he is a farmer. His plot of land has been handed down from father to son for generations. His plow, hand sickle, and threshing floor could have been used hundreds of years ago. Usually a grape grower, he wears a tasseled-scarf beret taken into battle by the old-time warriors as head padding (cover).

In the Lasíthi region lies the valley of 10,000 windmills. These ancient devices pump water to grapevines and olive trees, Crete's chief plantings. Below, a mill on Míkonos catches the breeze.

Delos, smallest of the Cyclades Islands, once held sway as the religious and polit-

the diagram below. The larger shapes are natural crystals; the smaller ones inside show how gems are cut from them.

Many crystals have strange electric abilities. Under pressure they generate a tiny charge.



IRVIN E. ALLEMAN, NATIONAL GEOGRAPHIC STAFF

SPARKLING GEMS are cut from relatively dull mineral crystals along the lines shown here. The bent line through the diamond shows how gem facets reflect light.

The force of sound waves from a person talking is enough to produce the effect. It also works in reverse—electric current makes the crystals change shape slightly. In thus converting mechanical energy to electrical, and vice versa, crystals become essential in radio equipment, telephone systems, phonographs, radar, and sonar.

Even the sugar bowl on your table generates electricity when there is a conversation going on, for each "grain" of sugar is a crystal. The tiny current is much too small to shock you, but large enough for scientists to measure.

Man-made crystals are the basis of a booming industry. They are grown from tiny "seed" crystals in solutions of the crystalline material, or else in high temperature furnaces. Some scientists work hard to produce crystals as nearly perfect as possible. Others want impure crystals. Crystals with just the right amount of impurity react to light by glowing—giving us the fluorescent light tube. A similar reaction inside a television picture tube produces the image. Other impure crystals light clock hands or allow today's photographic films to take pictures with less light than formerly. Transistors, which substitute for radio tubes, are imperfect crystals.

The huge salt crystals below, grown in the laboratory, can be split into pieces for study or use. The scientist taps his chisel with a hammer and the crystal falls apart along the cleavage line in the same way that diamonds split under a cutter's blows (see *Geographic School Bulletins*, February 2, 1959). These fragments will be polished for use in optical experiments and equipment. F.S.

HARSHAW CHEMICAL COMPANY

NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART

IMBEDDED IN A MASS OF QUARTZ crystals, upright columns of tourmaline display their crystalline structure. The woman admires a half-dozen different hues of the stone. Tourmaline is valuable in electrical instruments as well as in gems. Exposed to heat or pressure, it becomes electrically charged, a property used in depth detectors on shipboard.

Crystals — Everyday

EVEN IF YOU NEVER owned so much as a glass bead, much less a diamond, you are still surrounded by crystals.

Gem stones, including the tourmaline at left, are the glamor girls among crystals, but others fill your sugar bowl and salt shaker. The glowing of tiny crystals gives you your television picture. You can tune in a disk jockey on the radio because the station is kept always on the same frequency by crystals.

If you have a clock or wrist watch that glows in the dark, crystals work for you there, too. Crystals take your photograph, play phonograph records, help you talk on the telephone.

A crystal is simply a mass of similar atoms arranged in a pattern. This pattern is regularly repeated, like the pattern of wall paper, but it has thickness in addition to width and height.

Different substances form crystals of different shapes. Sometimes a single element can crystallize in more than one way—diamond and graphite are both crystallized carbon.

Crystal shapes are "fingerprints" of the elements. Each element has its own way of crystallizing, although all the patterns fall into six basic shapes, some of which are shown in

water through the gills behind the head into the interior cavity. Contracting its powerful muscles at a signal from the axon, it expels the water like a stream from a fire hose through a narrow funnel beneath its body.

In one respect the squid even outperforms a jet aircraft. It can scoot off in any direction it desires simply by pointing the funnel forward or backward. Two caudal fins at the front act like a submarine's diving planes to guide the squid's flight.

The same powerful muscles it uses to dart through the water give the squid its main defensive weapon—a squirt of brown ink. When attacked, it ejects a blossom of this liquid into the water between it and the potential enemy, dodges around behind. At the same time it changes color like a chameleon and speeds away from the confused adversary.

Squid ink is so durable that ink fossilized more than a hundred million years ago has been diluted and used for writing.

When the fisherman hooks into this agile giant, he has a nautical dragon by the tail. The squid flails at the line with tentacles bristling with suction cups that can fasten a slippery fish in a viselike grip. It bites at the leader with horny jaws that will snap even the strongest wire. This ill-tempered denizen of the sea will fight almost anything around him. This includes fellow citizens as big as a whale, or the stout end of a gaffing pole. Not without reason do Chilean and Peruvian fishermen call him "devil."

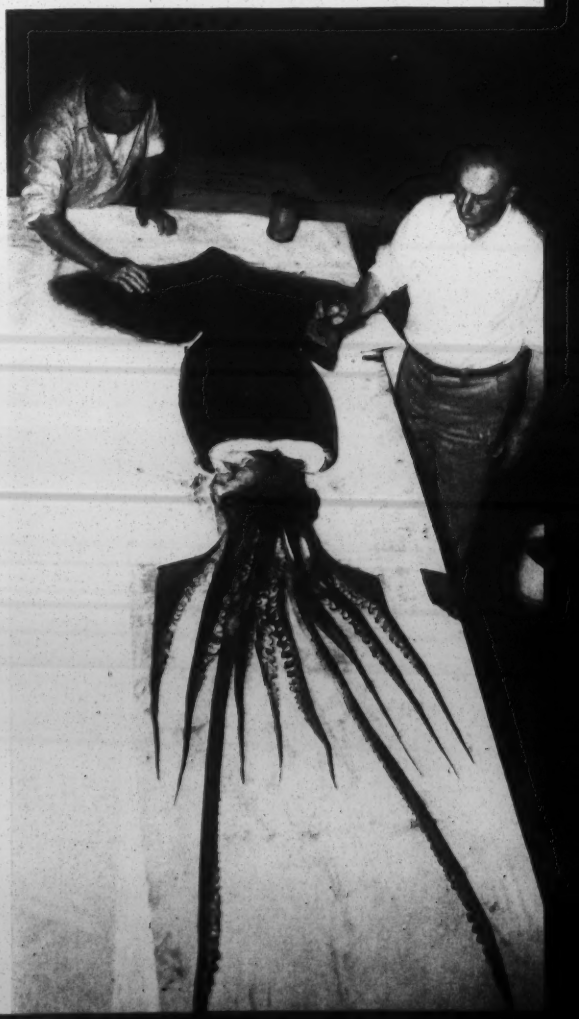
But the angler usually wins the battle. With luck a hard-won catch of squids reaches the docks of Valparaiso, Chile, where an organization has been set up to receive them.

An expert locates the axon along the squid's right side and from within the nerve sheath extracts the substance called axoplasm.

It is sent in iced thermos jars to Santiago. Flown to the United States, it reaches Cambridge, Massachusetts, where M. I. T. chemists immediately analyze it. Less than 60 hours after the big mollusks are brought to boat, a chemist is peering at the axoplasm through an electron microscope.

Research to date indicates that a squid's nerve is much like a human's, only bigger. Thus studying it could produce far-reaching answers to the functioning of man's nervous system. Scientists know a good deal about the end results produced by the operation of man's nerves; they know very little about the chemical make-up of a nerve.

The ugly squid may provide some vital clues. A. P. M.



UMI

PHOTOGRAPHS BY DAVID DOUGLAS DUNCAN

Homely Squid Has Big Nerve

ONE OF THE MOST REPULSIVE creatures of the deep is lending itself to medical science—but not without a struggle.

Beneath the jellylike exterior of the giant squid, disagreeable cousin of the octopus, stretches a giant nerve called an *axon*.

For the squid this oversized nerve acts as a lightning-fast alarm system, warning it of prowling enemies or succulent prey. For the biologist, the axon and its interior fluid, axoplasm, open new vistas to the study of the human nervous system. In humans, as in squids, nerves knit into an intricate communications network.

"When you consider that nervous and mental diseases are responsible for more hospital cases than any other type," says Dr. Francis O. Schmitt of Massachusetts Institute of Technology, where experiments with squid are being performed, "it becomes clear that research at the basic level is badly needed."

The axon's size—50 times larger than the average human nerve—gives investigators like Dr. Schmitt something big enough to work with. One axon from a giant squid from the Humboldt Current off the west coast of South America, they find, equals some 25 nerves from smaller squid taken off Cape Cod.

But the giant squid is understandably reluctant to offer itself to science—at M.I.T. or anywhere else. So vicious are these mollusks of the Humboldt that the Chilean and Peruvian fishermen who go after them (above) must cut peepholes in pillowcases, slip them over their heads to keep from getting an eyeful of squid ink.

When night falls, adventurous anglers go out to try to fill another laboratory order. Hunting is best at night since squid seem to follow the daily migration of plankton and small fish, reconnoitering in deep water during the day, following their prey close to the surface at night.

Fishermen discover a surprisingly fast customer at the end of their line. For the squid is jet propelled. Ages before man designed the jet engine, the squid and its cousins zoomed through primeval seas.

To get an idea of how the squid swims, glance at the photograph of the large specimen stretched out on the table below. (This prize squid gets a coat of olive oil from two officials of the American Museum of Natural History in New York. A plaster cast was later made of it for the museum.)

In the water, the squid usually moves "feet first." Pressing its eight tentacles into a tear-drop shape, it tows them along behind.

To get up speed, the squid expands its jacketlike mantle like a bellows, sucking

wide, the total land dedicated to national parks is 494,000 square miles, more than three times the area of California.

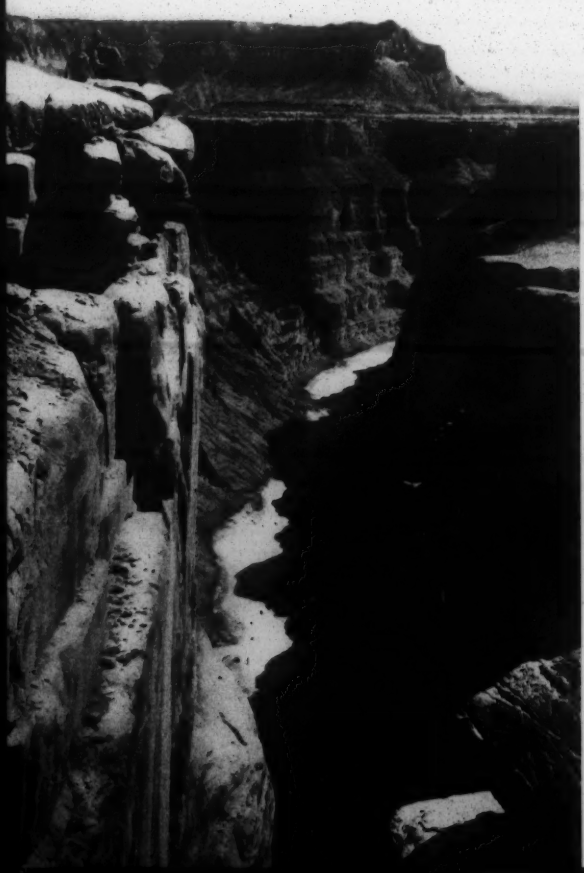
In the United States alone, 24,000,000 acres of land in 180 units from the Atlantic to the Pacific and scattered in Alaska, Puerto Rico, Hawaii, and the Virgin Islands attract millions of visitors.

No two are exactly alike. Yosemite spreads a visual feast of 760,951 acres of granite cliffs, rushing waterfalls, and rich, green forests. In stark contrast are Grand Canyon's varicolored flattopped rocks and deep gorges of the Colorado River.

Russell Cave, Alabama, given to the National Park Service by the National Geographic Society, is the newest parcel. Katmai National Monument, Alaska, with 2,697,590 acres, is the largest. The House Where Lincoln Died, in Washington, D. C., is the smallest.

DICK WOLFF

UNFENCED ZOO: In Kruger National Park, Union of South Africa, these lions and other animals from antelopes to zebras roam free. More than 100 reserves lie scattered over the face of Africa. BELOW: Arizona's Grand Canyon National Park.



JUSTIN LOCKE

Not all are parks in the usual sense of the word, nor do all carry that official designation. Only about one-third are notable primarily for their scenic value.

Others include such historic shrines as Independence National Historical Park in Philadelphia, Pa., where you can see the buildings in which the United States was formed.

In 1925 the national parks attracted few more than 2,000,000 visitors. In 1957 they drew 59,000,000. By 1966 park officials expect the figure to soar to between 80 and 100 million.

To take care of these crowds, the National Park Service is embarked on a 10-year, $800,000,000 improvement project. They call it Mission 66, in honor of the Service's 50th birthday coming up in 1966. L. B.

ANSEL ADAMS

National Parks: Your Wild Estate

NEARLY 89 YEARS AGO, a small group of men bedded down for the night around the dancing flames of a campfire in the Yellowstone country.

For five weeks they had explored vast areas of the land. They had seen roaring geysers, huge canyons, and dazzling waterfalls. As the coyotes howled in the distance, and owls hooted from near-by slopes, the men discussed what should be done with this natural wonderland.

They talked of staking personal claims. But nature seemed too beautiful for individual ownership. It ought to belong to everyone. One man suggested a national park, and Yellowstone National Park was conceived.

At the urging of these men, Congress passed the Yellowstone establishment act, and the first national park in the world came into being.

Every President and every Congress since 1872 have supported American national parks. When Yellowstone was such a success, Congress added others. Before the end of the century, Sequoia, Yosemite (above), and Mount Rainier were set aside as national parks.

Today Americans can enjoy seeing live volcanoes, or dinosaur bones; the cactus forest of Arizona's Saguaro National Monument, mountain goats in Glacier National Park, or a cave city in Mesa Verde National Park. They can follow wilderness trails through Grand Teton National Park, or ride a mule down Bright Angel Trail to the bottom of the Grand Canyon. All these—and much more—are owned by the people themselves.

The Park Service keeps staffs of naturalists, historians, archeologists, and rangers to instruct and protect the owners when they come to look over their estate.

Since Yellowstone was established as a national park, the idea has spread through 46 countries of the world. World-

PAUL A. ZAHL, NATIONAL GEOGRAPHIC STAFF; BELOW, U. S. AIR FORCE

Park Blooms In 50th State

GIANT FERN JUNGLE sprawls over the northeast corner of Kilauea, active volcano in Hawaii National Park. The visitor need not travel far from this rain-soaked forest to view a dry barren waste, the Kau Desert. In addition, the park boasts other luxuriant rain forests abounding in brilliant flowers; plus spectacular cliffs, rugged coastline, colorful native and imported birds, and mongooses from India. Museums offer maps, charts, and exhibits of the park's chief attractions, its three volcanoes (see below). Hawaii National Park is spread over two bodies of land—the islands of Hawaii and Maui. It was established by Congress in 1916. Since then the park has grown until today it stretches over 231,415 acres, most of them on the island of Hawaii. Mission 66 will add new roads and buildings, improved camping facilities, and a bigger park staff.

MAUNA LOA ERUPTS. The world's largest active volcano blows its top about every three-and-a-half years. Kilauea, also active, is near by on the island of Hawaii. Islanders call it the "drive-in" volcano. A highway runs into a parking lot near the crater's edge. Tourists walk a few steps to the rim of the steaming, fenced-in pit. Through years of study, scientists now recognize the danger signs of eruptions and are able to warn people away. The third volcano in the park is Haleakala on the island of Maui. Believed nearly dead, it last erupted two centuries ago.

UMI